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PHYSIOLOGY OF PULSATION BEHIND NADI PARIKSHA: AN AYURVEDIC AND MODERN PROSPECTIVE.

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Abstract:

Nadi Pariksha is a classical Ayurvedic diagnostic method described in Yogaratnakara, Sharangdhara Samhita and Bhavaprakasha. It evaluates the physiological and pathological state of the body through tactile examination of the radial pulse. In modern medicine, arterial pulsation is explained through cardiac physiology and electrophysiology. Kriya Sharir explains pulsation through Vyan Vayu circulating Rasa from Hridaya to the entire body. An integrative approach is needed to decode the scientific basis of Nadi Pariksha to understand the physiology of pulsation underlying Nadi Pariksha by correlating Ayurvediya Kriya Sharir concepts with modern cardiac physiology and electrophysiology. Despite widespread clinical use, the physiological basis of Nadi Pariksha remains poorly understood in modern terms. This paper aims to bridge the physiology of pulsation as perceived in Nadi Pariksha by correlating Ayurvedic concepts of Vyan Vayu, Rasa Samvahan and Hridaya Karma with modern cardio physiology, arterial pulse wave propagation and cardiac electrical activity.

Keywords: Nadi Pariksha, Kriya Sharir, Cardiac Physiology, Electrophysiology, Vyan Vayu, Rasa Samvahan, Pulse Wave

1. Introduction:

Ayurveda considers Roga Pariksha and Rogi Pariksha as two pillars of diagnosis. Among Rogi Pariksha, Nadi Pariksha holds a unique place due to its practiced in Ayurveda for centuries as a non-invasive diagnostic method. Samhitas describe Nadi as carrying the imprint of Tridosha, Dhatu, Agni, Ojas and Manas.[1] Nadi refers to the natural pulse of a healthy individual, used as a baseline for pathological comparison. Sharngadhara Samhita states: “Nadi pariksyam vijnaya rogamschaiva vinishchitam_” — by examining _Nadi, diseases can be ascertained.[2]

Modern cardiovascular physiology explains the pulse as a pressure wave generated by left ventricular contraction, transmitted through compliant arteries and modified by reflection from peripheral sites.[3] The characteristics of this wave — amplitude, upstroke, dicrotic notch and velocity — are influenced by stroke volume, heart rate, vascular tone and blood viscosity. Electrophysiology further explains that each mechanical systole is preceded by an orderly electrical activation from the sinoatrial node through the atrioventricular node, His-Purkinje system to ventricular myocardium.[4]

Nadi Pariksha is one of the Ashtavidha Pariksha in Ayurveda and is considered a primary tool for assessing Dosha status, Agni and Bala of the patient.[5] Surprisingly, even many medical students and doctors are not fully aware of - How exactly the pulse is formed, Why pulse is generated, How electrical activity in the heart becomes a palpable pulse wave, How stroke volume influences pulse quality and why different pulse characteristics manifest in different pathological state?

This study aims to bridge Ayurvediya Kriya Sharir concepts of Vyana Vayu, Rasa-Rakta Samvahana and Hridaya function with modern cardiac physiology and electrophysiology to decode the physiological basis of pulsation assessed in Nadi Pariksha

2. Method:

This is a conceptual integrative review. An Integrative Understanding of Cardiac Physiology, Electrophysiology and Ayurvediya Kriya Sharir in Nadi Pariksha.

3. **Material:** To achieve this aim, literary matter from Classical Ayurvedic samhitas including Charaka Samhita Sutrasthana, Sharangadhara Purvakhanda, Yogaratnakara Nadi Pariksha, Bhavaprakasha Purvakhanda and Ravana Samhita were studied.

Modern literature from Standard texts of Guyton & Hall Physiology, Braunwald's Cardiology, research on cardiac cycle, pulse wave velocity, HRV and ECG interpretation.

Overview of Circulation and the Circulatory System

3.1.1 Modern Physiological Perspective

The circulatory system consists of heart, arteries, veins, capillaries and blood. Its major functions include:

1. Transportation of oxygen and nutrients
2. Removal of carbon dioxide and metabolic waste
3. Hormonal transport
4. Thermoregulation
5. Immune support
6. Maintenance of homeostasis

Double Circulation: The circulatory mechanism where blood passes through the heart twice during one complete cycle.

Pulmonary Circulation: Heart → Lungs → Heart

Systemic Circulation: Heart → Body tissues → Heart[6]

3.1 Ayurvedic Understanding of Circulation

Although Ayurveda does not use the modern term "circulation," the concept is clearly explained through Hridaya, Dhamani, Rasa-Rakta Samvahana, Prana and Vyana Vayu.

Hridaya (Heart): According to Charaka Samhita, "Hridaya is the seat of consciousness." The heart is considered the seat of Prana, abode of Ojas, center of circulation, seat of mind and consciousness.

Dhamani (Arteries): Sushruta Samhita describes 24 Dhamanis. The word "Dhamani" itself implies: "A pulsating channel." Functions include transportation of Rasa and Rakta, propagation of pulsation, distribution of Prana and maintenance of systemic activity.[7]

Vyana Vayu: The most important Ayurvedic factor in understanding pulse and circulation. Functions include governs movement throughout the body, regulates circulation, maintains rhythmic cardiac activity, controls contraction and relaxation, facilitates pulse propagation. Acharya Charaka states "Vyana moves throughout the entire body."[8]

3.2 The Cardiac Cycle[9]

The cardiac cycle includes sequence of electrical and mechanical events occurring during one single heartbeat, lasting about 0.8 seconds. It alternates between systole and diastole across the atria and ventricles.

Ventricular Diastole Phases

1. Isovolumetric Relaxation: 0.10 sec

Ventricles relax, all valves closed. Pressure drops fast. No blood enters or leaves.

2. Rapid Ventricular Filling: 0.10 sec

Ventricular pressure < atrial pressure → AV valves open. Nearly 70-80% blood rushes in passively.

3. Diastasis / Reduced Filling: 0.20 sec

Ventricles nearly 80% full. Blood slowly trickles from veins → atria → ventricles.

4. Atrial Systole: 0.10 sec

Atria contract. Push final nearly 20-30% blood into ventricles. Ventricular filling complete.

Total ventricular diastole: 0.5 sec at 75 bpm.

Ventricular Systole Phases

5. Isovolumetric Contraction: 0.05 sec

Ventricles contract, all valves closed. Pressure builds fast → AV valves slam shut = S1 "lub". No blood leaves yet.

6. Rapid Ejection: 0.10 sec

Ventricular pressure > aorta/pulmonary artery semilunar valves open. About 70% of stroke volume ejected rapidly.

7. Reduced Ejection: 0.15 sec

Contraction slows. Remaining approx. 30% blood exits as pressure drops → semilunar valves close = S2 "dub". Systole ends.

Total ventricular systole: 0.3 sec at 75 bpm

3.2.1 Ayurvedic Correlation of Cardiac Activity [10]

The rhythmic activity of the heart is governed by Prana Vayu, Vyana Vayu, Sadhaka Pitta, Avalambaka Kapha.

Prana Vayu: Responsible for initiation, regulation, control mechanisms. Functionally compared with neural regulation.

Vyana Vayu: Responsible for propulsion, distribution, circulatory movement, pulse manifestation.

Sadhaka Pitta: Responsible for transformation, functional intelligence, coordinated activity. Correlated with electrophysiological intelligence and metabolic cardiac activity.

Avalambaka Kapha: Provides structural support, lubrication, stability, mechanical cushioning.

3.3 Role of Neural Impulse and Electrophysiology of the Heart

The heart possesses an intrinsic electrical conduction system.

Conducting System of the Heart:

SA Node - Natural pacemaker in right atrium

AV Node - Delays impulse transmission

Bundle of His and Purkinje Fibres - Rapid conduction to ventricles [11]

3.3.1 Electrical Activity and ECG

An electrocardiogram (ECG) is a quick, non-invasive test that records the heart's electrical activity using electrodes placed on the skin. It displays three signals as follows:

P Wave: that corresponds to Atrial depolarization

QRS Complex: Ventricular depolarization of heart muscle.

T-Wave: Ventricular repolarization of heart muscle.[12]

3.3.2 Ayurvedic Interpretation of Electrophysiology

Classical Ayurveda does not describe electricity directly, but functional principles are similar.

Prana Vayu: Impulse initiation and regulation

Vyana Vayu: Impulse propagation and circulation

Sadhaka Pitta: Transformation, intelligence and coordination

Ojas: Synchronization, vitality and rhythmic integrity

Disturbance in these may manifest as arrhythmias, irregular pulse, variable pulse amplitude, Vata-dominant pulse characteristics.[13]

3.4 How is Pulse Created?

Pulse is NOT the direct movement of blood itself. Pulse is a pressure wave generated in the arterial wall due to left ventricular systole.

Mechanism of Pulse Formation:

Step 1: Left ventricle contracts

Step 2: Aortic valve opens

Step 3: Blood is forcefully ejected into the aorta

Step 4: The aortic wall stretches

Step 5: Elastic recoil generates a pressure wave

This pressure wave travels through arteries and becomes palpable as pulse.[14]

Stroke Volume: Amount of blood ejected by one ventricle during one contraction. Approx. 70 mL/ beat. Cardiac Output = Heart Rate × Stroke Volume.

Relationship Between Pulse and Stroke Volume:

When stroke volume increases: Pulse becomes full, bounding

When stroke volume decreases: Pulse becomes weak, thready

Its Clinical Correlations as follows:

High Stroke Volume States: Fever, hyperthyroidism, Pitta aggravation

Low Stroke Volume States: Shock, dehydration, Dhatu Kshaya, Vata predominance [15]

Ayurvedic Understanding of Pulse Manifestation:

Vata Pulse: Irregular, variable, serpentine movement, uneven tension

Pitta Pulse: Warm, sharp, active, forceful

Kapha Pulse: Deep, broad, stable, slow and steady

These pulse characteristics reflect combinations of cardiac output, vascular tone, arterial elasticity and hemodynamic status.[16]

Nadi Feature	Ayurveda	Modern Equivalent
Gati	Sarpa/Manduka/Hamsa	Heart rate, rhythm, HRV
Vega	Tivra/Manda	Pulse Pressure, Stroke Volume
Sthiratva	Sthira/Chala	Vascular compliance
Kathinya	Kathin/Mridu	Arterial stiffness, PWV

3.5 How is Pulse Propagated?

3.5.1 Modern Physiological Explanation

The pulse wave travels faster than blood flow itself.

Pulse Wave Velocity (PWV): Normally 5-15 m/sec. Depends upon arterial elasticity, vessel stiffness, blood pressure, age.

Important Physiological Observation is the pulse felt at the wrist is not the direct blood column but the transmitted pressure wave. This explains why carotid, radial and femoral pulses differ in quality and timing.[17]

3.5.2 Ayurvedic Understanding of Pulse Propagation

In Ayurveda, Dhamanis are considered "Spandamana Vahini"- pulsating channels. Vyana Vayu propagates motion, circulation, pulsation and functional communication throughout the body. Thus, Nadi is not merely blood pressure or arterial movement. It is the external manifestation of Dosha dynamics, Guna predominance, Dhatu status, Agni, Ojas and Pranic rhythm.[18]

Result and discussion: "Nadi examination" is not merely the art of feeling pulsations beneath the fingertips. It is the living expression of the interaction between the heart, circulation, neural impulses, prana, vascular dynamics, doshas and consciousness itself. Pulse is not direct blood flow, but a pressure wave generated by left ventricular systole, propagated through arterial elastic recoil. Gati correlates with heart rate, rhythm and HRV governed by SA node and autonomic tone. Vega reflects pulse pressure and stroke volume. Kathinya and sthiratva correspond to arterial stiffness and vascular compliance measured as PWV. Vata Nadi exhibits serpentine, irregular characteristics analogous to arrhythmias and high vagal tone; Pitta Nadi is sharp, forceful, matching hyperdynamic states; Kapha Nadi is slow, broad, stable, akin to bradycardia and low SVR. Vyana Vayu functionally represents the integrated neuro-humoral-hemodynamic axis for circulation. ECG events precede mechanical pulsation, providing the electrophysiological basis for Spandana.

Conclusion

Nadi is not merely heartbeat, arterial pulsation, or blood pressure. It is the integrated expression of cardiac mechanical activity, neural rhythm, vascular elasticity, Prana and Vyana dynamics, Dosha manifestation, Dhatu nourishment, Ojas and consciousness. A subtle electrical impulse generated within the heart becomes coordinated contraction, pressure generation, pulse wave propagation and palpable Nadi beneath the physician's fingers. Thus, Nadi is the language of the body's living rhythmic intelligence.

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